
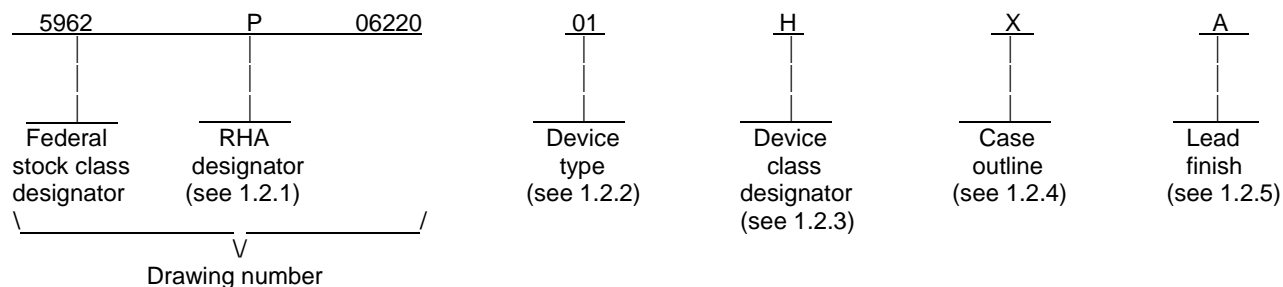


REVISIONS																			
LTR	DESCRIPTION												DATE (YR-MO-DA)				APPROVED		
A	Table I; Change $V_{RIP}$ non-RHA subgroup 1 max. limit from 180 to 250 mVp-p. Change $V_{RIP}$ non-RHA subgroups 2 and 3 max limit from 200 to 280 mVp-p. Change $V_{RIP}$ RHA subgroups 1, 2, and 3 max limit from 250 to 330. Change Eff non-RHA subgroup 1 min limit from 66 to 61 percent. Change Eff non-RHA subgroups 2 and 3 min limit from 65 to 60 percent. Change Eff RHA subgroups 1, 2, and 3 min limit from 62 to 57 percent. Change $P_D$ non-RHA subgroup 1 max. limit from 26 to 29 W. Change $P_D$ non-RHA subgroups 2 and 3 max. limit from 28 to 31 W. Change $P_D$ RHA subgroups 1, 2, and 3 max. limit from 30 to 33 W. Add footnote 1 to table II, under group C end-point electricals. -gc												09-09-16				Charles F. Saffle		
B	Table I; For the power dissipation ( $P_D$ ) test, combined subgroup 1 with subgroups 2 and 3 for pre-irradiation testing with the maximum limit of 31 W. Paragraph 4.3.5 table for the single event upset survival level (LET) changed the units from "MeV" to "MeV-cm <sup>2</sup> /mg". Updated drawing paragraphs. -sld												12-03-01				Charles F. Saffle		
C	Update to current RHA format. Table I: For "External sync range" test in conditions column, correct "TTL" to "Active high". Figure 2: correct terminal symbol for terminal 2 from " $V_{IN}$ return" to "Input return". Corrections throughout to accurately reflect device testing and characteristics. -gc												15-01-29				Charles F. Saffle		
																			
REV																			
SHEET																			
REV	C	C																	
SHEET	15	16																	
REV STATUS			REV		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
OF SHEETS			SHEET		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
PMIC N/A			PREPARED BY Greg Cecil					<b>DLA LAND AND MARITIME</b> <b>COLUMBUS, OHIO 43218-3990</b> <a href="http://www.landandmaritime.dla.mil">http://www.landandmaritime.dla.mil</a>											
<b>STANDARD MICROCIRCUIT DRAWING</b>  THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE  AMSC N/A			CHECKED BY Greg Cecil																
			APPROVED BY Robert M. Heber					<b>MICROCIRCUIT, HYBRID, 3.3 VOLT SINGLE CHANNEL, DC-DC CONVERTER</b>											
			DRAWING APPROVAL DATE 08-04-03																
			REVISION LEVEL <b>C</b>					SIZE A	CAGE CODE <b>67268</b>	<b>5962-06220</b>									
					SHEET 1 OF 16														

## 1. SCOPE

1.1 Scope. This drawing documents five product assurance classes as defined in paragraph 1.2.3 and MIL-PRF-38534. A choice of case outlines and lead finishes which are available and are reflected in the Part or Identifying Number (PIN). When available, a choice of radiation hardness assurance levels are reflected in the PIN.

1.2 PIN. The PIN shall be as shown in the following example:



1.2.1 Radiation hardness assurance (RHA) designator. RHA marked devices shall meet the MIL-PRF-38534 specified RHA levels and shall be marked with the appropriate RHA designator. A dash (-) indicates a non-RHA device.

1.2.2 Device type(s). The device type(s) identify the circuit function as follows:

<u>Device type</u>	<u>Generic number</u>	<u>Circuit function</u>
01	SMRT283R3S	DC-DC converter, 23 W, 3.3 V output

1.2.3 Device class designator. This device class designator shall be a single letter identifying the product assurance level. All levels are defined by the requirements of MIL-PRF-38534 and require QML Certification as well as qualification (Class H, K, and E) or QML Listing (Class G and D). The product assurance levels are as follows:

<u>Device class</u>	<u>Device performance documentation</u>
K	Highest reliability class available. This level is intended for use in space applications.
H	Standard military quality class level. This level is intended for use in applications where non-space high reliability devices are required.
G	Reduced testing version of the standard military quality class. This level uses the Class H screening and In-Process Inspections with a possible limited temperature range, manufacturer specified incoming flow, and the manufacturer guarantees (but may not test) periodic and conformance inspections (Group A, B, C and D).
E	Designates devices which are based upon one of the other classes (K, H, or G) with exception(s) taken to the requirements of that class. These exception(s) must be specified in the device acquisition document; therefore the acquisition document should be reviewed to ensure that the exception(s) taken will not adversely affect system performance.
D	Manufacturer specified quality class. Quality level is defined by the manufacturers internal, QML certified flow. This product may have a limited temperature range.

1.2.4 Case outline(s). The case outline(s) are as designated in MIL-STD-1835 and as follows:

<u>Outline letter</u>	<u>Descriptive designator</u>	<u>Terminals</u>	<u>Package style</u>
X	See figure 1	12	Flanged Package

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1.2.5 Lead finish. The lead finish shall be as specified in MIL-PRF-38534.

1.3 Absolute maximum ratings. 1/

Supply voltage range ( $V_{IN}$ ) .....	-0.5 V dc to +80 V dc
Power dissipation ( $P_D$ ):	
Device type 01 (non-RHA) .....	31 W
Device type 01 (RHA levels P, R and F) .....	33 W
Output power .....	23 W
Lead soldering temperature (10 seconds) .....	+300°C
Storage temperature range .....	-65°C to +150°C

1.4 Recommended operating conditions.

Supply voltage range ( $V_{IN}$ ) .....	+19 V dc to +56 V dc
Case operating temperature range ( $T_C$ ) .....	-55°C to +125°C

1.5 Radiation features. 2/ 3/

Maximum total dose available (dose rate = 9 rads(Si)/s) .....	300 krad(Si) 4/
Maximum total dose available (dose rate = 50 - 300 rads(Si)/s) .....	100 krad(Si) 5/
Maximum total dose available (dose rate $\leq$ 10 mrad(Si)/s) .....	100 krad(Si) 5/
Single event phenomenon (SEP) effective linear energy transfer (LET):	
No SEL, SEB, SEFI, SEGR .....	$\leq$ 86 MeV-cm <sup>2</sup> /mg 6/
SEU .....	$\leq$ 86 MeV-cm <sup>2</sup> /mg 7/

2. APPLICABLE DOCUMENTS

2.1 Government specification, standards, and handbooks. The following specification, standards, and handbooks form a part of this drawing to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATION

MIL-PRF-19500 - Semiconductor Devices, General Specification for.  
MIL-PRF-38534 - Hybrid Microcircuits, General Specification for.  
MIL-PRF-38535 - Integrated Circuits (Microcircuits) Manufacturing, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-883 - Test Method Standard Microcircuits.  
MIL-STD-1835 - Interface Standard for Electronic Component Case Outlines.  
MIL-STD-461 - Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment.

- 1/ Stresses above the absolute maximum ratings may cause permanent damage to the device. Input voltage transients between 56 and 80 volts are allowed for no more than 120 milliseconds. Extended operation at the maximum levels may degrade performance and affect reliability.
- 2/ See 4.3.5 for the manufacturer's radiation hardness assurance analysis and testing.
- 3/ Bipolar device types may degrade from displacement damage from radiation which could affect RHA levels. These device types have not been characterized for displacement damage.
- 4/ These parts may be dose rate sensitive in a space environment and may demonstrate enhanced low dose rate effects. Radiation end-point limits for the noted parameters are guaranteed only for the conditions as specified in MIL-STD-883, method 1019, condition C, tested at 9 rads(Si)/s.
- 5/ A representative device was initially High Dose Rate (HDR) tested using Condition A of method 1019 of MIL-STD-883 to 150 krad(Si) to ensure RHA designator level "R" (100 krad(Si)). A representative device has also been Low Dose Rate (LDR) tested using Condition D of Method 1019 of MIL-STD-883 to 100 krad(Si). A representative device will be re-tested after design or process changes that can affect RHA response of this device.
- 6/ Single event was performed on a representative device to 86 meV-cm<sup>2</sup>/mg with no latch-up, burn-out, functional interrupts, or gate ruptures exhibited.
- 7/ Single event upsets (transients voltages) were exhibited to the limit specified. See table IB.

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DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-103 - List of Standard Microcircuit Drawings.  
MIL-HDBK-780 - Standard Microcircuit Drawings.

(Copies of these documents are available online at <http://quicksearch.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM F1192 - Standard Guide for the Measurement of Single Event Phenomena (SEP) Induced by Heavy Ion Irradiation of Semiconductor Devices.

2.3 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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### 3. REQUIREMENTS

3.1 Item requirements. The individual item performance requirements for device classes D, E, G, H, and K shall be in accordance with MIL-PRF-38534. Compliance with MIL-PRF-38534 shall include the performance of all tests herein or as designated in the device manufacturer's Quality Management (QM) plan or as designated for the applicable device class. The manufacturer may eliminate, modify or optimize the tests and inspections herein, however the performance requirements as defined in MIL-PRF-38534 shall be met for the applicable device class. In addition, the modification in the QM plan shall not affect the form, fit, or function of the device for the applicable device class.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-PRF-38534 and herein.

3.2.1 Case outline. The case outline shall be in accordance with 1.2.4 herein and figure 1.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 2.

3.2.3 Radiation exposure circuit. The radiation exposure circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing and acquiring activity upon request.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and shall apply over the full specified operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are defined in table I.

3.5 Marking of device(s). Marking of device(s) shall be in accordance with MIL-PRF-38534. The device shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's vendor similar PIN may also be marked.

3.6 Data. In addition to the general performance requirements of MIL-PRF-38534, the manufacturer of the device described herein shall maintain the electrical test data (variables format) from the initial quality conformance inspection group A lot sample, for each device type listed herein. Also, the data should include a summary of all parameters manually tested, and for those which, if any, are guaranteed. This data shall be maintained under document revision level control by the manufacturer and be made available to the preparing activity (DLA Land and Maritime -VA) upon request.

3.7 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to supply to this drawing. The certificate of compliance (original copy) submitted to DLA Land and Maritime -VA shall affirm that the manufacturer's product meets the performance requirements of MIL-PRF-38534 and herein.

3.8 Certificate of conformance. A certificate of conformance as required in MIL-PRF-38534 shall be provided with each lot of microcircuits delivered to this drawing.

### 4. VERIFICATION

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-PRF-38534 or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein.

4.2 Screening. Screening shall be in accordance with MIL-PRF-38534. The following additional criteria shall apply:

a. Burn-in test, method 1015 of MIL-STD-883.

(1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to either DLA Land and Maritime -VA or the acquiring activity upon request. Also, the test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1015 of MIL-STD-883.

(2)  $T_A$  as specified in accordance with table I of method 1015 of MIL-STD-883.

b. Interim and final electrical test parameters shall be as specified in table II herein, except interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

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TABLE IA. Electrical performance characteristics.

Test	Symbol	Conditions <u>1/ 2/</u> -55°C ≤ T <sub>C</sub> ≤ +125°C V <sub>IN</sub> = 28 V dc ±0.5 V no external sync, C <sub>L</sub> = 0 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Output voltage V <sub>OUT</sub>	V <sub>OUT</sub>	I <sub>OUT</sub> = 6.97 A	1	01	3.267	3.333	V dc
			2,3		3.234	3.366	
			P,R,F		3.18	3.42	
Output current	I <sub>OUT</sub>	V <sub>IN</sub> = 19 V dc, 28 V dc, and 50 V dc	1,2,3	01		6.97	A
			P,R,F			6.97	
Output ripple voltage V <sub>OUT</sub>	V <sub>RIP</sub>	I <sub>OUT</sub> = 6.97 A B.W. < 20 MHz,	1	01		250	mVp-p
			2,3			280	
			P,R,F			330	
Line regulation V <sub>OUT</sub>	V <sub>RLINE</sub>	I <sub>OUT</sub> = 6.97A V <sub>IN</sub> = 19 V dc to 50 V dc	1,2,3	01		30	mV
			P,R,F			60	
Load regulation V <sub>OUT</sub>	V <sub>RLOAD</sub>	I <sub>OUT</sub> = 0 to 6.97 A	1,2,3	01		40	mV
			P,R,F			60	
Input current	I <sub>IN</sub>	I <sub>OUT</sub> = 0, Inhibit (pin 3) = 0 V dc (tied to pin 2)	1,2,3	01		50	mA
			P,R,F			60	
		I <sub>OUT</sub> = 0, Inhibit (pin 3) open	1,2,3			110	
			P,R,F			120	
Input ripple current <u>3/</u>	I <sub>RIP</sub>	I <sub>OUT</sub> = 6.97 A, B. W. < 20 MHz	1,2,3	01		50	mAp-p
			P,R,F			60	
Efficiency	Eff	I <sub>OUT</sub> = 6.97 A,	1	01	61		%
			2,3		60		
			P,R,F		57		

See footnotes at end of table

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TABLE IA. Electrical performance characteristics - Continued.

Test	Symbol	Conditions <u>1/ 2/</u> -55°C ≤ T <sub>C</sub> ≤ +125°C V <sub>IN</sub> = 28 V dc ±0.5 V no external sync, C <sub>L</sub> = 0 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Isolation	ISO	Input to output or to sync return, or any pin to case at 500 V dc T <sub>C</sub> = +25°C	1	01	100		MΩ
			P,R,F 1		100		
Capacitive load <u>4/ 5/</u> V <sub>OUT</sub>	C <sub>L</sub>	No effect on dc performance T <sub>C</sub> = +25°C	4	01		5000	μF
			P,R,F 4			5000	
Power dissipation	P <sub>D</sub>	Short circuit: P <sub>D</sub> = P <sub>N</sub> – total P <sub>OUT</sub>	1,2,3	01		31	W
			P,R,F 1,2,3			33	
Switching frequency	F <sub>S</sub>	I <sub>OUT</sub> = 6.97 A	4,5,6	01	270	330	kHz
			P,R,F 4,5,6		270	330	
External sync range <u>6/</u>	F <sub>SYNC</sub>	I <sub>OUT</sub> = 6.97 A active high level to pin 4	4,5,6	01	270	330	kHz
			P,R,F 4,5,6		270	330	
Output response to step load transient <u>7/</u> V <sub>OUT</sub>	V <sub>OLOAD</sub>	50 percent load to/from 100 percent load	4,5,6	01		450	mV pk
			P,R,F 4,5,6			700	
Recovery time from step load transient <u>7/ 8/</u> V <sub>OUT</sub>	T <sub>TLOAD</sub>	50 percent load to/from 100 percent load	4,5,6	01		3	ms
			P,R,F 4,5,6			4	
Output response to step line transient <u>5/ 9/</u> V <sub>OUT</sub>	V <sub>OLOAD</sub>	I <sub>OUT</sub> = 6.97 A Input step = 19 V dc to/from 50 V dc	4,5,6	01		500	mV pk
			P,R,F 4,5,6			1000	
Recovery time from to step line transient <u>5/ 8/ 9/</u> V <sub>OUT</sub>	T <sub>TLINE</sub>	I <sub>OUT</sub> = 6.97 A Input step = 19 V dc to/from 50 V dc	4,5,6	01		4	ms
			P,R,F 4,5,6			5	

See footnotes at end of table.

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TABLE IA. Electrical performance characteristics - Continued.

Test	Symbol	Conditions <u>1/ 2/</u> -55°C ≤ T <sub>C</sub> ≤ +125°C V <sub>IN</sub> = 28 V dc ±0.5 V no external sync, C <sub>L</sub> = 0 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Start up overshoot V <sub>OUT</sub>	V <sub>tonOS</sub>	I <sub>OUT</sub> = 6.97 A V <sub>IN</sub> = 0 to 28 V dc,  P,R,F	4,5,6	01		50	mV pk
			4,5,6			100	
Start up delay <u>10/</u> V <sub>OUT</sub>	T <sub>onD</sub>	I <sub>OUT</sub> = 6.97 A V <sub>IN</sub> = 0 to 28 V dc  P,R,F	4	01		32	ms
			5,6			35	
			4,5,6			40	
Load fault recovery <u>5/ 8/</u> V <sub>OUT</sub>	T <sub>rLF</sub>	I <sub>OUT</sub> = from S.C. to 6.97 A.  P,R,F	4,5,6	01		25	ms
			4,5,6			30	

- 1/ Pre and post irradiation values are identical, unless otherwise specified in table I. Post irradiation parameters shall be tested in accordance with Table II herein.
- 2/ A representative device was initially High Dose Rate (HDR) tested using Condition A of method 1019 of MIL-STD-883 to 150 krad(Si) to ensure RHA designator level "R" (100 krad(Si)). A representative device has also been Low Dose Rate (LDR) tested using Condition D of Method 1019 of MIL-STD-883 to 100 krad(Si). A representative device will be retested after design or process changes that can affect RHA response of this device.
- 3/ Converter input ripple current emissions are compliant to MIL-STD-461 conducted emission test CE-102.
- 4/ Capacitive load may be any value from 0 to the maximum limit without compromising dc performance.
- 5/ Parameter shall be tested as part of design characterization and after design or process changes; thereafter, the parameters shall be guaranteed to limits specified in Table I.
- 6/ A active high waveform (V<sub>IH</sub> = 4.5 V minimum, V<sub>IL</sub> = 0.8 V maximum) with a 50 percent ±10 percent duty cycle applied to the sync input pin (pin 4) within the sync range frequency shall cause the converter's switching frequency to become synchronous with the frequency applied to the sync input pin (pin 4).
- 7/ Load step transition time is greater than 10 microseconds.
- 8/ Recovery time is measured from the initiation of the transient to where V<sub>OUT</sub> has returned to within 1 percent of V<sub>OUT</sub> final value.
- 9/ Input step transition time is greater than 10 microseconds.
- 10/ Start up delay time measurement is either for a step application of power at the input or the removal of a ground signal from the inhibit pin (pin 3) while power is applied to the input.

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TABLE IB. SEP test limits. 1/

Device Type	SEP	Temperature (T <sub>C</sub> )	Conditions/Results	Effective linear energy transfer (LET)
01	SEL (Destructive)	+25°C	None	$\leq 86 \text{ MeV-cm}^2/\text{mg}$
01	SEB	+25°C	None	$\leq 86 \text{ MeV-cm}^2/\text{mg}$
01	SEGR	+25°C	None	$\leq 86 \text{ MeV-cm}^2/\text{mg}$
01	SEFI	+25°C	None	$\leq 86 \text{ MeV-cm}^2/\text{mg}$
01	SEU (transient Voltages)	+25°C	Typically less than +/- 200 mV for 500nS	$\leq 86 \text{ MeV-cm}^2/\text{mg}$

1/ For SEP test conditions, see 4.3.5.1.1.3 herein.

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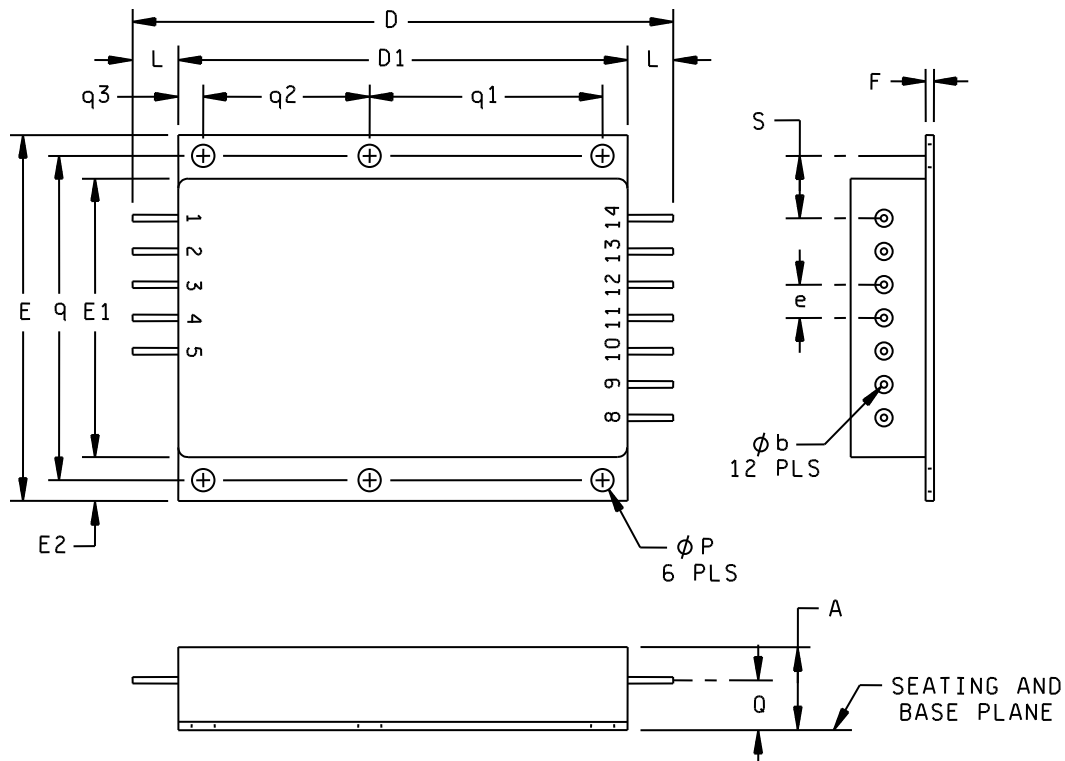
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Case outline X.



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		10.16		.400
$\phi b$	0.89	1.14	.035	.045
D		82.93		3.265
D1		68.71		2.705
E	55.75	56.01	2.195	2.205
E1	42.42	42.67	1.670	1.680
E2	6.53	6.78	.257	.267
e	4.95	5.21	.195	.205
F	1.14	1.40	.045	.055
L		6.86		.270
$\phi P$	3.30	3.56	.130	.140
Q	5.46	5.72	.215	.225
q	49.40	49.66	1.945	1.955
q1	35.43	35.69	1.395	1.405
q2	25.27	25.53	.995	1.005
q3	3.68	3.94	.145	.155
S	9.40	9.65	.370	.380

NOTES:

1. Each pin is insulated from the metal package by a ceramic seal.
2. The U.S. government preferred system of measurement is the metric SI. This item was designed using inch-pound units of measurement. In case of problems involving conflicts between the metric and inch-pound units, the inch-pound units shall rule.
3. Lead identification for reference only.
4. Device weight: 100 grams maximum.

FIGURE 1. Case outline.

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Device type	01
Case outline	X
Terminal number	Terminal symbol
1	V <sub>IN</sub>
2	Input return
3	Inhibit
4	Sync input
5	Sync return
8	Sense
9	Sense return
10	V <sub>OUT</sub> A return
11	V <sub>OUT</sub> A
12	Trim
13	V <sub>OUT</sub> A
14	V <sub>OUT</sub> A return

FIGURE 2. Terminal connections.

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TABLE II. Electrical test requirements.

MIL-PRF-38534 test requirements	Subgroups (in accordance with MIL-PRF-38534, group A test table)
Interim electrical parameters	- - -
Final electrical parameters	1*, 2, 3, 4, 5, 6
Group A test requirements	1, 2, 3, 4, 5, 6
Group C end-point electrical <u>1/</u> parameters	1, 2, 3
End-point electrical parameters for radiation hardness assurance (RHA) devices <u>2/</u>	1, 2, 3, 4, 5, 6

1/ As a minimum, for all Group C testing performed after (09-09-16) manufacturers shall perform subgroups 1, 2, and 3 from the Group A electrical test table (Table C-Xa of MIL-PRF-38534).

2/ During radiation testing, Group A electrical tests (subgroups 1, 2, 3, 4, 5, and 6) are performed pre exposure and post anneal only. For interim electrical tests, subgroups 1, 3, 4, and 6 are performed. Subgroups 2 and 5 (high temperature) are not performed so as to minimize the effects of anneal on interim data.

\* PDA applies to subgroup 1.

4.3 Conformance and periodic inspections. Conformance inspection (CI) and periodic inspection (PI) shall be in accordance with MIL-PRF-38534 and as specified herein.

4.3.1 Group A inspection (CI). Group A inspection shall be in accordance with MIL-PRF-38534 and as follows:

- a. Tests shall be as specified in table II herein.
- b. Subgroups 7, 8, 9, 10, and 11 shall be omitted.

4.3.2 Group B inspection (PI). Group B inspection shall be in accordance with MIL-PRF-38534.

4.3.3 Group C inspection (PI). Group C inspection shall be in accordance with MIL-PRF-38534 and as follows:

- a. End-point electrical parameters shall be as specified in table II herein.
- b. Steady-state life test, method 1005 of MIL-STD-883.
  - (1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to either DLA Land and Maritime -VA or the acquiring activity upon request. Also, the test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1005 of MIL-STD-883.
  - (2) T<sub>A</sub> as specified in accordance with table I of method 1005 of MIL-STD-883.
  - (3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

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4.3.4 Group D inspection (PI). Group D inspection shall be in accordance with MIL-PRF-38534.

4.3.5. Radiation hardness assurance (RHA). RHA qualification is required only for those devices with the RHA designator as specified herein. See table IIIA and IIIB.

Table IIIA. Radiation Hardness Assurance Methods Table.

RHA method Employed	Active elements tested only as part of the hybrid device.	Tested		Worst Case Analysis				End points after final dose	
		Element Level	Hybrid Device Level	Performed using extreme value analysis				Element Level	Hybrid device level
				Includes temperature effects	Combines temperature and radiation effects	Combines total dose and displacement effects	End-of-life		
	No	Tested See Table IIIB	Tested See Table IIIB	Yes	Yes	No	No	T <sub>C</sub> = +25°C and -55°C	T <sub>C</sub> = +25°C, +125°C, and -55°C

Table IIIB. Hybrid level and element level test table..

Radiation Test		Total Dose			Heavy Ion	Proton/Neutron
		Low Dose Rate	High Dose Rate (HDR)	ELDRS Characterization	SEP	Displacement Damage (DD)
Hybrid Level Testing		Tested Level P (30 krad(Si))	Tested Level P (45 krad(Si))	No	Tested (86 MeV-cm <sup>2</sup> /mg)	Not Tested <u>1/</u>
		Tested Level R (100 krad(Si))	Tested Level R (150 krad(Si))			
Element Level Testing	Bipolar Discrete <u>2/</u> Devices	No	QML die <u>3/</u>	No	No	Not Tested <u>1/</u>
		No	Tested Non QML die <u>4/</u>			
	Bipolar Linear or Mixed Signal > 90 nm <u>2/</u>	No	QML die <u>3/</u>	No	No	Not Tested <u>1/</u>
		No	Tested Non QML die <u>4/</u>			

1/ Testing will be performed and this SMD will be updated to include these tests when completed.

2/ Bipolar Junction Transistors (BJT) may not be tested for TID if the design margin for critical parameters are 2X minimum as determined by design analysis.

3/ Purchased QML die are tested by the die manufacturer at rated dose of 30 krad(Si) for level P, and 100 krad(Si) for level R.

4/ Non QML die are tested at 1.5X rated dose. 1.5X rated dose is 45 krad(Si) for level P, and 150 krad(Si) for level R.

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4.3.5.1 Radiation Hardness Assurance (RHA) inspection. RHA qualification is required for those devices with the RHA designator as specified herein. End-point electrical parameters for radiation hardness assurance (RHA) devices shall be specified in table II. Radiation testing will be in accordance with the qualifying activity (DLA Land and Maritime-VQ) approved plan and with MIL-PRF-38534, Appendix G.

- a. The hybrid device manufacturer shall establish procedures controlling element radiation testing, and shall establish radiation test plans used to implement element lot qualification during procurement. Test plans and test reports shall be filed and controlled in accordance with the manufacturer's configuration management system.
- b. The hybrid device manufacturer shall designate a RHA program manager to oversee element lot qualification, and to monitor design changes for continued compliance to RHA requirements.

4.3.5.1.1 Hybrid level radiation qualification.

4.3.5.1.1.1 Qualification by similarity. A family is defined by the family model designator e.g. SMRT28. All parts with this designator share a common design and use the same active elements except diodes. Device type 5962F0720201KXC was initially characterized and tested for TID at both HDR and LDR. Device type 5962F0720201KXC was characterized for SEP. These characterizations will be repeated for any changes that may affect the radiation response of these devices.

4.3.5.1.1.2 Total ionizing dose irradiation testing. A representative device is characterized and tested initially and after any design or process change that may affect the RHA response of this device. Devices in the part family, e.g. SMRT28, are tested at HDR in accordance with condition A of method 1019 of MIL-STD883 and at LDR in accordance with condition D of method 1019 of MIL-STD-883. HDR samples are tested to a minimum of 1.5 times the rated dose to ensure rated dose. LDR samples are tested to a minimum of 1 times the rated dose. A minimum of one biased and one unbiased device will be tested for post radiation electrical performance and compared.

4.3.5.1.1.3 Single event phenomena (SEP). A minimum of one representative hybrid of the hybrid family is characterized for SEE response at initial qualification and after any design or process change which may affect the RHA response of the device type. Testing shall be performed in accordance with ASTM F1192. Test conditions for SEP are as follows:

- a. The ion beam angle of incidence shall be normal to the die surface. No shadowing of the ion beam due to fixturing is allowed.
- b. The fluence shall be  $\geq 1 \times 10^6$  particles/cm<sup>2</sup>.
- c. The flux shall be between  $10^2$  and  $10^5$  ions/cm<sup>2</sup>/s.
- d. The particle range shall be  $\geq 35$  micron in silicon.
- e. The characterization is performed at nominal input voltage between 21 and 35 volts with loads varied from 30 percent to 50 percent. The test temperature shall be  $+25^\circ\text{C} \pm 10^\circ\text{C}$  in air.
- f. For SEP test limits, see table IB herein.

4.3.5.1.2 Element level radiation qualification.

4.3.5.1.2.1 Technologies not being tested. Testing is not performed on device technologies including: P/N, Schottky and zener diodes, and on small signal bipolar junction transistors that the manufacturer considers to be radiation hardened. Bipolar Junction Transistors (BJT) may not be tested for TID if the design margin for critical parameters are 2X minimum as determined by design analysis.

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4.3.5.1.2.2 Total Ionizing Dose Irradiation. Every initial wafer lot of bipolar / BiCMOS linear or mixed signal semiconductor components will be characterized and tested at HDR in accordance with condition A of method 1019 of MIL-STD-883 to the specified total dose. Eleven samples will be tested under the bias condition which produces the greatest parametric shift. P99/90% statistics are applied to the element parameters as compared against limits in the component SCD which are established by the worst case circuit analysis. Low dose rate testing per Condition D has been performed at the hybrid level. Component changes may be qualified at hybrid level or the die will be characterized at the element level with condition D of method 1019 of MIL-STD-883. When element level low dose rate testing is performed ten samples (5 biased and 5 unbiased) will be tested to the specified total dose. P99/90% statistics are applied to the element parameters as compared against limits established by the worst case circuit analysis.

4.3.5.2 Radiation Lot Acceptance. Each lot of active elements, except as stated in 4.3.5.1.2.1 shall be evaluated for acceptance in accordance with MIL-PRF-38534 and herein.

4.3.5.2.1 Total Ionizing Dose. All active elements (except as noted in 4.3.5.1.2.1) are either purchased at the radiation level of the hybrid (i.e., P or R) as MIL-PRF-38535 Standard Microcircuit Drawing (SMD) or MIL-PRF-19500 JAN where the electrical performance meets those established for the elements at hybrid device design, or subject to lot acceptance testing (LAT). LAT consists of HDR testing on every wafer lot in accordance with condition A of method 1019 of MIL-STD-883 to 45 krad(Si) for level P hybrid devices, and 150 krad(Si) for levels R hybrid devices. A minimum of 10 samples will be tested (5 biased and 5 unbiased) unless the worst case test condition has been determined reducing the sample to 5. P99/90% statistics are applied to the element parameter as compared against limits established in the component SCD which are established by worst case circuit analysis for lot acceptance.

## 5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-PRF-38534.

## 6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use for Government microcircuit applications (original equipment), design applications, and logistics purposes.

6.2 Replaceability. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

6.3 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated as specified in MIL-PRF-38534.

6.4 Record of users. Military and industrial users shall inform DLA Land and Maritime when a system application requires configuration control and the applicable SMD to that system. DLA Land and Maritime will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronic devices (FSC 5962) should contact DLA Land and Maritime-VA, telephone (614) 692-8108.

6.5 Comments. Comments on this drawing should be directed to DLA Land and Maritime-VA, Columbus, Ohio 43218-3990, or telephone (614) 692-1081.

6.6 Sources of supply. Sources of supply are listed in MIL-HDBK-103 and QML-38534. The vendors listed in MIL-HDBK-103 and QML-38534 have submitted a certificate of compliance (see 3.7 herein) to DLA Land and Maritime-VA and have agreed to this drawing.

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6.7 Additional information. When applicable, a copy of the following additional data shall be maintained and available from the device manufacturer:

- a. RHA upset levels.
- b. Test conditions (SEP).
- c. Occurrence of latchup (SEP).
- d. Occurrence of Burn-out (SEP).
- e. Occurrence of Gate Rupture (SEP).
- f. Occurrence of Single Event Functional Interrupt (SEP).
- g. Occurrence of Single Event Upset (SEP).

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## STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE:15-01-29

Approved sources of supply for SMD 5962-06220 are listed below for immediate acquisition information only and shall be added to MIL-HDBK-103 and QML-38534 during the next revisions. MIL-HDBK-103 and QML-38534 will be revised to include the addition or deletion of sources. The vendors listed below have agreed to this drawing and a certificate of compliance has been submitted to and accepted by DLA Land and Maritime -VA. This information bulletin is superseded by the next dated revisions of MIL-HDBK-103 and QML-38534. DLA Land and Maritime maintains an online database of all current sources of supply at <http://www.landandmaritime.dla.mil/Programs/Smcr/>.

Standard microcircuit drawing PIN <u>1/</u>	Vendor CAGE number	Vendor similar PIN <u>2/</u>
5962-0622001HXA 5962-0622001HXC	<u>3/</u> <u>3/</u>	SMRT283R3S/HO SMRT283R3S/HO
5962P0622001HXA 5962P0622001HXC	50821 50821	SMRT283R3S/HP SMRT283R3S/HP
5962R0622001HXA 5962R0622001HXC	50821 50821	SMRT283R3S/HR SMRT283R3S/HR
5962P0622001KXA 5962P0622001KXC	50821 50821	SMRT283R3S/KP SMRT283R3S/KP
5962R0622001KXA 5962R0622001KXC	50821 50821	SMRT283R3S/KR SMRT283R3S/KR
5962F0622001KXA 5962F0622001KXC	<u>3/</u> <u>3/</u>	SMRT283R3S/KF SMRT283R3S/KF

- 1/ The lead finish shown for each PIN representing a hermetic package is the most readily available from the manufacturer listed for that part. If the desired lead finish is not listed contact the Vendor to determine its availability.
- 2/ Caution. Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.
- 3/ Not available from an approved source of supply.

Vendor CAGE  
number

50821

Vendor name  
and address

Crane Electronics Incorporated  
10301 Willows Road NE  
Redmond, WA 98052

The information contained herein is disseminated for convenience only and the Government assumes no liability whatsoever for any inaccuracies in the information bulletin.